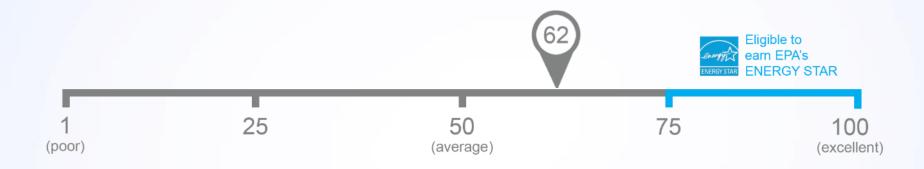


Introducing the New 1-100 ENERGY STAR Score for Single-Family Homes

Craig Haglund and Matt Burgess ENERGY STAR Commercial Buildings U.S. Environmental Protection Agency October 17, 2022



The 1-100 ENERGY STAR Score



One simple number understood by ALL stakeholders.



Property types with 1-100 ENERGY STAR scores



Bank Branch



Barracks*



Courthouses



Data Centers



Distribution Centers



Financial Offices



Hospitals



Hotels



K-12 Schools



Office Buildings



Medical Offices



Multifamily Housing



Residence Hall/Dormitory*



Retail Stores



Senior Care Communities



Supermarkets



Warehouses



Wastewater
Treatment Plants*



Wholesale club/ Supercenters



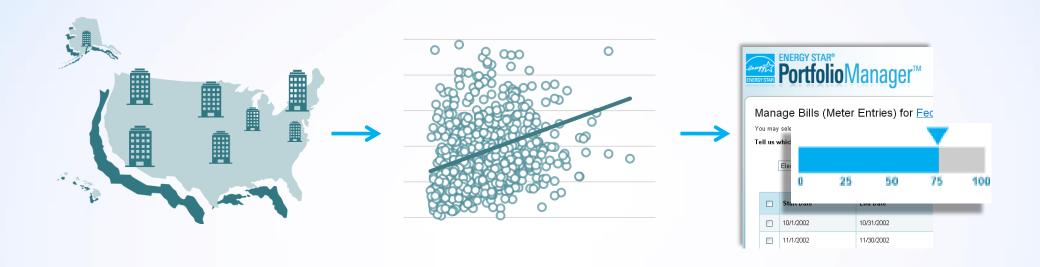
Worship Facilities



3

^{*} ENERGY STAR Certification not available

Scores Based on Market Data

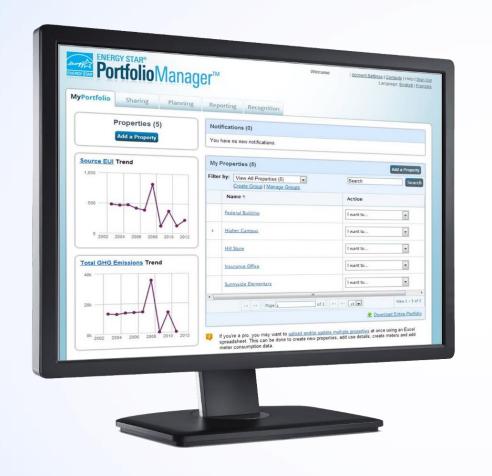


Nationally representative survey - CBECS gathers data on building characteristics and energy use from thousands of buildings across the U.S. EPA creates a **statistical model** that correlates the energy data with the property use details to identify the key drivers of energy use, accounting for weather variations

Compares the actual energy data for a building to the modeled estimate to determine where the building ranks relative to its peers on a 1-100 scale



ENERGY STAR® Portfolio Manager®





Assess energy, water and waste/materials consumption and GHG emissions



Track changes over time



1-100 ENERGY STAR score



Apply for ENERGY STAR certification

www.energystar.gov/benchmark





So why did the commercial buildings program want to have a score for single-family homes?

- More commercial building partners asking about benchmarking single-family homes as they begin to invest in single-family rentals.
- Local and state governments have expressed interest in measuring the performance of homes as part of programs aimed at improving home energy performance.
- We discovered there's an entire industry for corporate-owned single family rental homes (and one approached us asking about benchmarking their entire portfolio):
 - Invitation Homes 80,000 homes
 - Progress Residential 70,000 homes
 - American Homes 4 Rent 55,000 homes
 - Tricon Residential 31,000 homes
 - FirstKey Homes 25,000 homes



The Solution . . . Sort of

- Simple performance-based tool that compares a home's <u>actual</u> annual energy use to other similar homes.
- Uses a statistical algorithm to take into account the effects of local weather, home size, and number of occupants to give a simple 0-10 score.
- Used by over 500,000 homeowners
- Linked to by utilities, home improvement contractors, state/local governments, etc.



Assess the energy efficiency of your home and see how it measures up:

EPA's Home Energy Yardstick provides a simple assessment of your home's annual energy use compared to similar homes. By answering a few basic questions about your home, you can get:

- · Your home's Home Energy Yardstick score (on a scale of 0 to 10);
- Insights into how much of your home's energy use is related to heating and cooling versus other
 everyday uses like appliances, lighting, and hot water;
- Links to guidance from ENERGY STAR on how to increase your home's score, improve comfort, and lower utility bills; and
- · An estimate of your home's annual carbon emissions

Learn more about how the Home Energy Yardstick works.

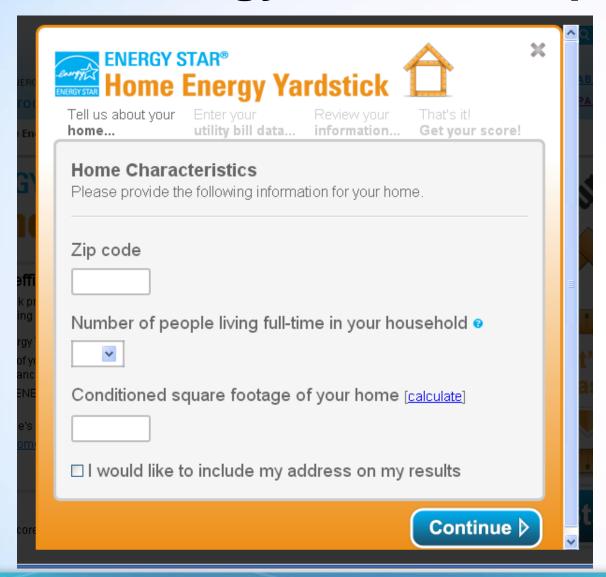
See a sample results page

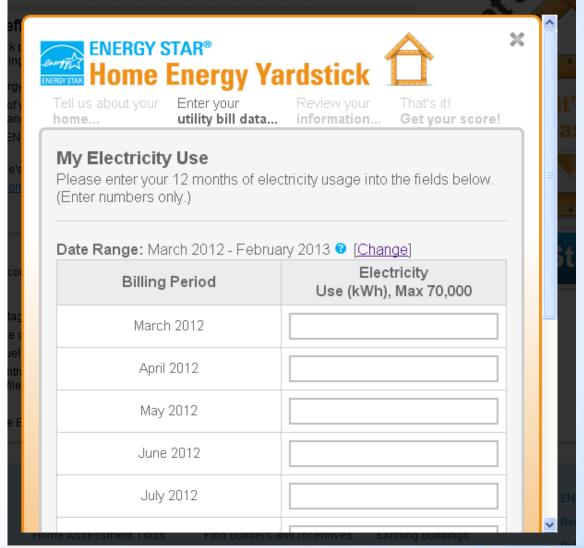


Want to save your information? Click here to create an account!



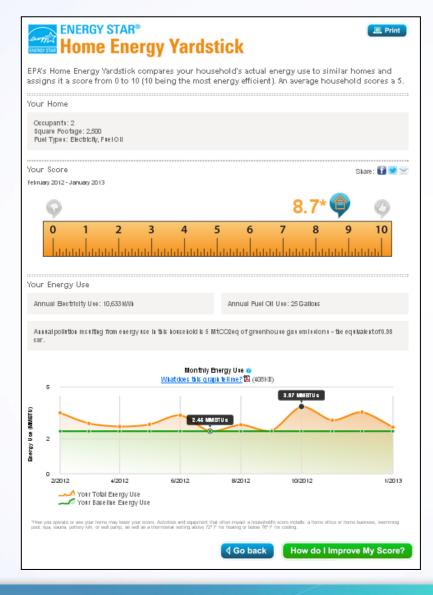
Home Energy Yardstick Inputs







Home Energy Yardstick Results





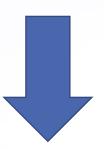
Hmm . . .

- Home Energy Yardstick (HEY)
 provides a score that compares a
 home against similar homes.
- HEY scores are developed via regression modeling using RECS data.
- Portfolio Manager provides a score that compares a building against similar buildings.
- ENERGY STAR scores are developed via regression modeling using CBECS data.

Portfolio Manager already has the ability to enter single family homes manually or via web services.











Home Energy Yardstick/Portfolio Manager Integration

- HEY score programmed into Portfolio Manager.
- HEY score converted from 0-10 to 1-100 scale to match all other scores in Portfolio Manager.
- No changes to the data required to receive a score:
 - Zip code
 - Square footage
 - Number of full-time residents
- Automated data transfer available via web services.
- HEY remains available as a standalone tool
 - New design to match Portfolio Manager design.
 - Homeowners pointed toward HEY; corporate owners pointed toward Portfolio Manager.
 - After receiving score in HEY users can save data into a Portfolio Manager account.



Score Development Principles

- Measure variability in actual energy use among buildings with the same business activity
 - Do not want/expect to have an exact prediction of energy consumption
- Focus on business activity/service provided
- Adjust for characteristics that describe how a building operates (e.g. hours, workers), not why it performs a certain way
- Do not adjust for specific technologies
 - For example: if 100% LED lighting saves energy, we don't want to compare properties with 100% LED only to each other; we want to compare them to everyone. The least efficient among the buildings with 100% LED may still be better than the typical building without.



ENERGY STAR Score Statistical Methodology

```
Energy Intensity = C_0 + C_1^*Operating Hours + C_2^*Workers per Square Foot + C_3^*Computer per Square Foot + C_4^*HDD + C_5^*CDD + ...
```

- Coefficients represent average responses
- Coefficients provide adjustments for each operational characteristic
 - Does not add the kWh of each piece of equipment
 - Does adjust energy based on correlation between operating characteristic and energy use
- Yields a Predicted Energy Use Intensity, which is compared against the Actual EUI.



ENERGY STAR Score Statistical Methodology

The Score Does

- ✓ Evaluate as-billed energy use relative to building operations
- ✓ Normalize for operational characteristics (e.g., size, number of employees, cash registers, computers, climate)
- ✓ Depend on a statistically representative sample of the commercial building population

The Score Does Not

- * Sum the energy use of each piece of equipment
- Normalize for technology choices or market conditions (e.g., type of lighting, energy price)
- * Explain why a building operates as it does



Portfolio Manager Single-Family Home Score

- Model developed using similar core methodologies with analytical work performed by same contractor analysis team
- Developed with data from DOE's 2015 Residential Energy Consumption Survey (RECS)
 - 3,495 Observations in final dataset
- Many potential drivers of energy use were considered/analyzed
 - Gross Floor Area
 - Electric Well Pump Geographic
 - Location More than 20
 - Showers per Week
 - Number of Household Members

- Number of Lights on > 12 hours/day
- Number of Televisions Number of
- Windows Refrigeration / Freezers
- Year Built Heating Degree Days
- Cooling Degree Days
- Determined adjustments should be made for
 - Gross Floor Area
 - Number of Household Members
 - Weather and Climate (using Heating and Cooling Degree Days, retrieved based on ZIP code)



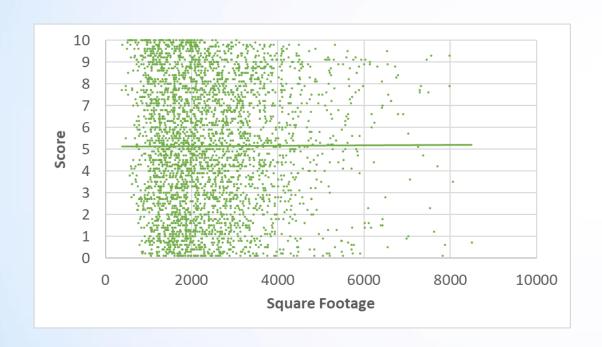
Portfolio Manager Single-Family Home Score – Differences from other ENERGY STAR scores

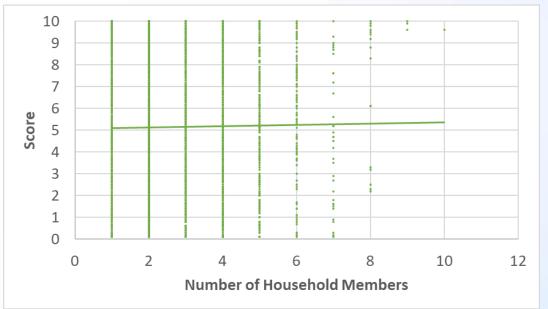
- Lower number of adjustments used for business activities keeps it simple
 - Home size, number of household members, and weather adjustments
- Uses source energy as the dependent variable instead of source energy use intensity
 - Mathematically, this ends up being a minor difference since the size of the home is included as an independent variable
- No intercept used in the model
 - Again, results in only minor mathematical difference in terms of score calculation
- Does not use centered variables.
 - Results in no difference to the score. This is a mathematical transformation that is just optical and used to improve the interpretability of the ENERGY STAR Score



Portfolio Manager Single-Family Home Score – ENERGY STAR review

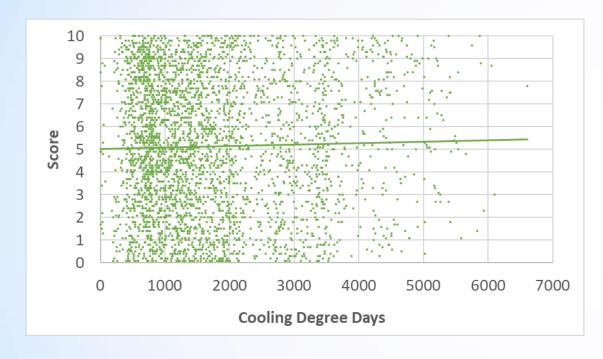
 ENERGY STAR analysis team performed review of technical details and analysis to determine the score met our standards before launching in Portfolio Manager

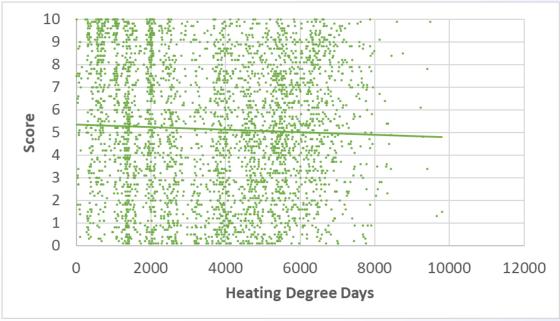




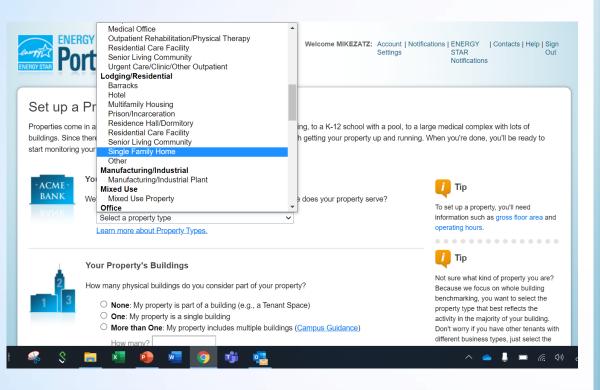


Portfolio Manager Single-Family Home Score – ENERGY STAR review







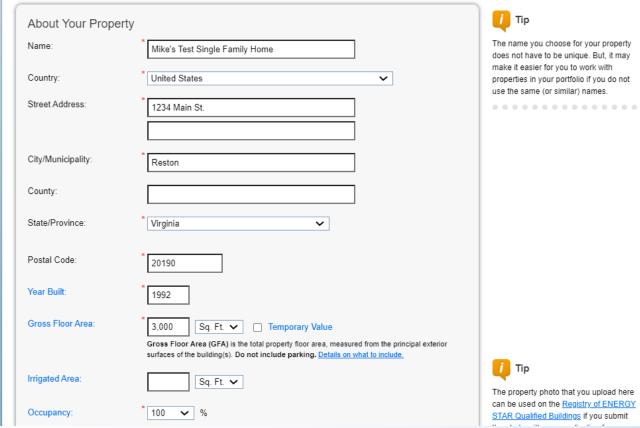




Welcome MIKEZATZ: Account | Notifications | ENERGY | Contacts | Help | Sign Settings STAR Out Notifications

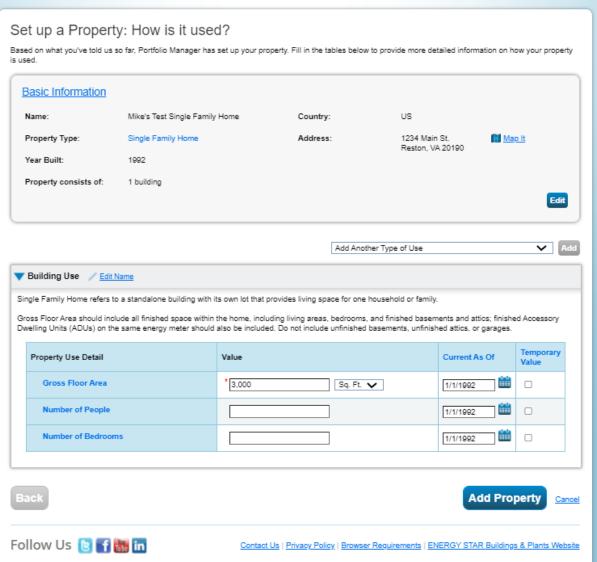
Set Up a Property: Basic Property Information

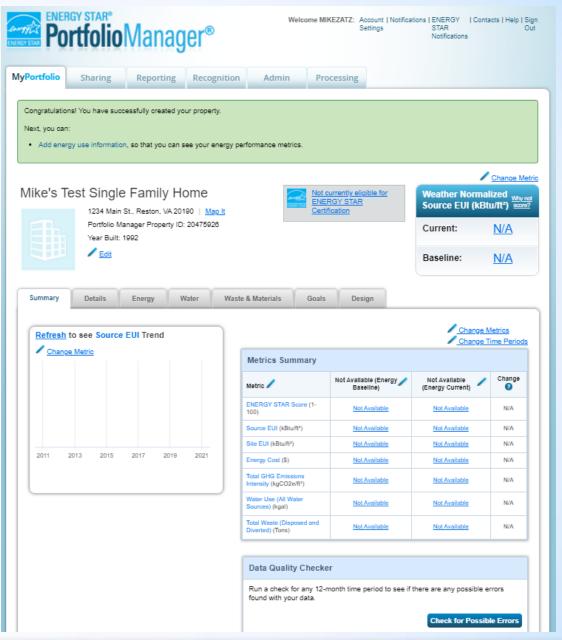
Tell us a little bit more about your property, including a name that you will use to look up your property and its address.













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Sharing Admin Processing Reporting Recognition

Mike's Test Single Family Home



1234 Main St., Reston, VA 20190 | Map It Portfolio Manager Property ID: 20475926

NERGY STAR

✓ Change Metric Weather Normalized Why no Source EUI (kBtu/ft²) score Current: N/A

Baseline: N/A

Add A Meter

Energy Summary Details

Water

Waste & Materials

Goals

Design

Meter Summary

0 Energy Meters Total In order to receive metrics for your property, you must provide meters. You have not entered any meters yet.

Add A Meter

Current Energy Date Not Available

Enter Your Bills

Five Ways to Enter Bill Data

- 1. Manual (Instructions here)
- 2. Use our simple spreadsheet (on the bottom of each meter's Manage Bills page) to upload or Copy/Paste
- 3. Use our complex spreadsheet (multiple meters + multiple properties)
- 4. Hire an organization to electronically enter your data
- 5. See if your utility offers this service

Meters - Used to Compute Metrics (0)

Niew as a Diagram

There are currently no energy meters entered for this property/building. In order to track energy usage and receive energy metrics, you must provide an energy meter. Enter information about your energy meters to begin tracking energy usage. After entering the meter, you will need to choose to include it in your metrics

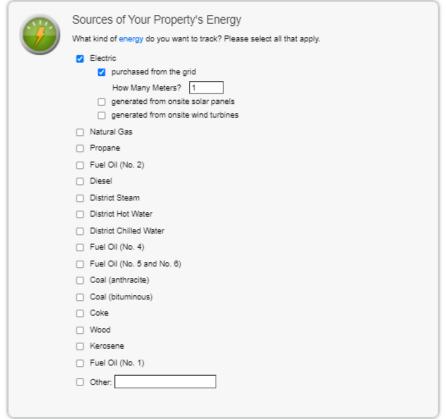
For a step-by-step guide to entering meter data, see How to get Utility Data into Portfolio Manager.



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Get Started Setting Up Meters for Mike's Test Single Family Home

There are five ways to enter meter data. First, you can enter manually, starting below. Second, you can set up your meters below, then upload a specially formatted spreadsheet with just your bill data. Third, for advanced users, you can use our upload tool that allows you to set up all of your meters and enter bill data. Fourth, you can hire a company to update your data electronically. And finally, you can see if your utility offers the service to update your energy data automatically.





Tracking Energy

To track your energy, create an energy meter for each source of energy from a utility, a neighboring building, or an onsite solar or wind panel. If you purchase a raw fuel (e.g. gas) and produce your own fuel (e.g., electricity or chilled water), you only need a meter for the fuel you purchased (e.g. gas), and not for the fuel you produce.



. Two Meters Needed for Onsite Solar/Wind

If you've got onsite Solar (or Wind), you still need to enter an Electric Grid Meter. Learn More.



. 📻 Automate Your Meter Entries

There are many organizations that will electronically enter your utility data into Portfolio Manager. Many utilities provide this service for free. Service providers integrate this service into their own software and value-added offerings. Learn more.

.

Get Started!









Welcome MIKEZATZ: Account | Notifications | ENERGY | Contacts | Help | Sign State State Out Notifications

Your meters have been created! If you have your energy consumption information for these meters, you can enter it below. Or, you can continue with setting up your meters and enter your energy bills later.

Your Meter Entries for Mike's Test Single Family Home

Now we need actual energy consumption information in order to start providing you with your metrics and, possibly, your score!

1 Energy Meter(s) for Mike's Test Single Family Home

TElectric Grid Meter

Start Date	End Date	Usage kWh (thousand Watt-hours)	Total Cost (\$)	Estimation	Green Power	Demand (kW)	Demand Cost (\$)
1/1/2021	2/1/2021	2,000					
2/1/2021	3/1/2021	1,800					
3/1/2021	4/1/2021	1,500					
4/1/2021	5/1/2021	1,000					
5/1/2021	6/1/2021	800					
6/1/2021	7/1/2021	1,200					
7/1/2021	8/1/2021	1,400					
8/1/2021	9/1/2021	1,100					
9/1/2021	10/1/2021	1,000					
10/1/2021	11/1/2021	1,150					
11/1/2021	12/1/2021	1,400					
12/1/2021	1/1/2022	1,850					

★ Delete Selected Entries

- --- Add Another Entry
- Learn how to copy/paste

Upload data in bulk for this meter:



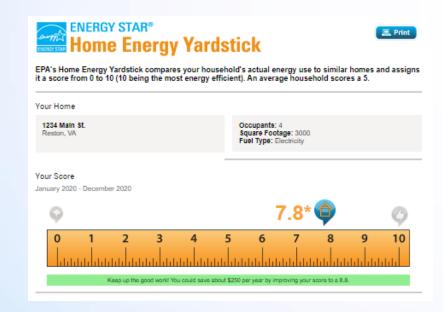
- Upload the completed file below
- . Copy and Paste the data into the table above

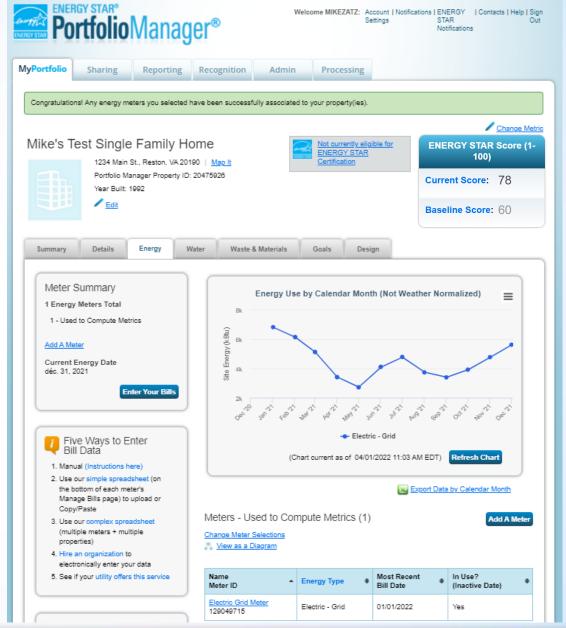
Choose File No file chosen





- You're now ready to:
 - Review energy performance.
 - See GHG emissions associated with energy use.
 - Share information with others.
 - Print reports.







Home Energy Yardstick Inputs



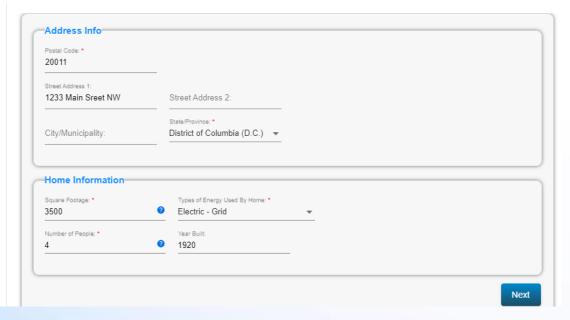
Home Energy Yardstick (powered by Portfolio Manager)

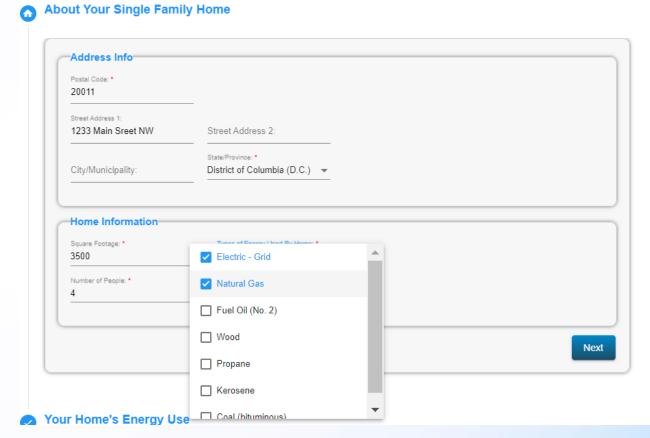
EPA's Home Energy Yardstick provides a simple assessment of your home's annual energy use compared to similar homes. By answering a few basic questions about your home, you can get:

- . Your home's ENERGY STAR score (on a scale of 1 to 100, with an average home scoring 50);
- . Insights into how much of your home's energy use is related to heating and cooling versus other everyday uses like appliances, lighting, and hot water;
- · Links to guidance from ENERGY STAR on how to increase your home's score, improve comfort, and lower utility bills
- · An estimate of your home's annual carbon emissions

Scores may not be available for the most recent 12-month period. ENERGY STAR uses real-time weather data to calculate your home's score and it usually takes until the 10th of the month to upload the previous month's weather data. For example, from Jan 1-10, you might get an error that your score for the period ending Dec 31 is not available.

About Your Single Family Home

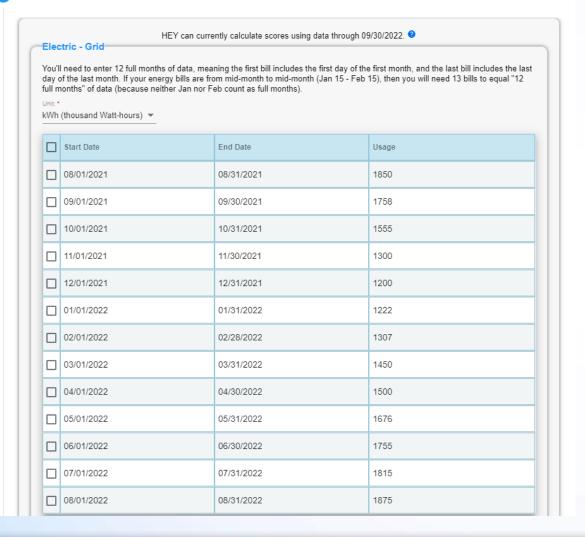






Home Energy Yardstick Meter Entries

Your Home's Energy Use



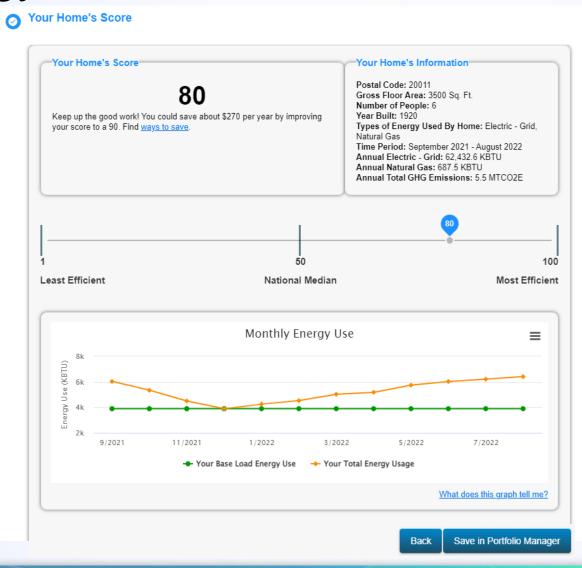
Jnit: •	nonths" of data (because neither Jahnousand cubic feet)	in nor 1 do count de lair mondie).	
	Start Date	End Date	Usage
	08/01/2021	08/31/2021	400
	09/01/2021	09/30/2021	450
	10/01/2021	10/31/2021	500
	11/01/2021	11/30/2021	550
	12/01/2021	12/31/2021	670
	01/01/2022	01/31/2022	700
	02/01/2022	02/28/2022	675
	03/01/2022	03/31/2022	650
	04/01/2022	04/30/2022	500
	05/01/2022	05/31/2022	450
	06/01/2022	06/30/2022	445
	07/01/2022	07/31/2022	440
	08/01/2022	08/31/2022	400

O LOCAL DE

View Results



Home Energy Yardstick Results



How can you use the single-family home score?

- Single-Family Rental Owners/Managers Assess properties' energy use, identify underperforming homes to target for efficiency improvements, and track savings over time at both the individual home and portfolio level.
- Energy Consulting/Engineering Firms Expand your business with existing clients and bring on new clients in the single-family rental industry.
- Local/State Governments and Utilities Use Portfolio Manager reporting features to measure and track the effectiveness of efficiency programs by including the 1-100 ENERGY STAR score for single-family homes and other key metrics in home retrofit programs.
- Corporate Sustainability Teams Encourage employees to benchmark their homes and participate in a company-wide energy-savings campaign.
- Schools, Libraries, Congregations, and Others Encourage families to benchmark their homes and, if available, check out local utility incentives.
- Individual Homeowners Benchmark their home and track savings when implementing energy efficiency measures.



Need More Info

- Buildings Homepage <u>www.energystar.gov/buildings</u>
- Portfolio Manager <u>www.energystar.gov/benchmark</u>
- 1-100 ENERGY STAR Score for Single-Family Homes in the U.S. Technical Reference - https://www.energystar.gov/buildings/tools-and-resources/energy_star_score_single_family_homes_united_states
- Home Energy Yardstick <u>www.energystar.gov/yardstick</u>
- ENERGY STAR for New Homes https://www.energystar.gov/newhomes
- Training www.energystar.gov/buildingstraining
- Help www.energystar.gov/buildingshelp

